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SOLICITATION AMENDMENT
MODIFICATION DE L'INVITATION

The referenced document is hereby revised; unless otherwise indicated, all other terms and conditions of the Solicitation remain the same.

Ce document est par la présente révisé; sauf indication contraire, les modalités de l'invitation demeurent les mêmes.

Comments - Commentaires

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Title - Sujet Environmental Logistics Depot	
Solicitation No. - N° de l'invitation F1700-195560/A	**Amendment No. - N° modif.** 007
Client Reference No. - N° de référence du client F1700-195560	**Date** 2020-06-18
GETS Reference No. - N° de référence de SEAG PW-$PWY-020-8768	
File No. - N° de dossier PWY-9-42228 (020)	**CCC No./N° CCC - FMS No./N° VME**
Solicitation Closes - L'invitation prend fin **at - à** 02:00 PM **on - le** 2020-06-26	**Time Zone** **Fuseau horaire** Pacific Daylight Saving Time PDT
F.O.B. - F.A.B. **Plant-Usine:** ☐ **Destination:** ☑ **Other-Autre:** ☐	
Address Enquiries to: - Adresser toutes questions à: Ly, Ronny(PWY)	**Buyer Id - Id de l'acheteur** pwy020
Telephone No. - N° de téléphone (604) 318-5750 ( )	**FAX No. - N° de FAX** (604) 775-6633
Destination - of Goods, Services, and Construction: **Destination - des biens, services et construction:** DFO – Port Hardy, BC	

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Name and title of person authorized to sign on behalf of Vendor/Firm (type or print) **Nom et titre de la personne autorisée à signer au nom du fournisseur/ de l'entrepreneur (taper ou écrire en caractères d'imprimerie)** **Signature** **Date**	

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Les documents français seront disponibles sur demande

This Amendment 007 is raised to issue Addendum #5.

ALL OTHER TERMS AND CONDITIONS REMAIN UNCHANGED.

ADDENDUM #5

Date: June 18, 2020

PACIFIC REGION
PORT HARDY LOGISTICS DEPOT
PORT HARDY, B.C.
Project No: 8H500

The following revisions supersede the information contained in the original drawings and specification issued for the above named project, and shall become part thereof. No consideration will be allowed for extras due to the contractor or any subcontractor not being familiar with this Addendum.

1.0 SPECIFICATIONS

1.1 Section 06 10 00 Rough Carpentry
Add:
1.0 General
.1 All wood framing, including bridging, nailing and other details, shall be as indicated on the structural drawings and comply with CAN/CSA-086 and the current British Columbia building code.

.2 The use of finger jointed wood shall be restricted to vertical members unless prior approval is given by the engineer of record.

.3 Shear walls shall be constructed as detailed on the drawings. All couplers for hold down rods shall have min 125% capacity of connecting rods and shall have "witness" holes.

.4 Floor sheathing and roof sheathing to be as detailed on the drawings. Panel edge nailing pattern shall also apply to drag struts and diaphragm edges.

.5 The following minimum shank diameters shall apply to nails specified on the structural drawings, in particular shearwall sheathing, floor and roof diaphragms:

Nail size minimum	Shank diameter
57 mm (2 1/4")	2.52 mm (0.099")
65 mm (2 1/2")	3.33 mm (0.131")
75 mm (3")	3.76 mm (0.148")
83 mm (3 1/4")	3.76 mm (0.148")
89 mm (3 1/2")	4.12 mm (0.162")

.6 Diaphragm and shearwall nails shall be full headed nails.

.7 Diaphragm and shearwall nails shall not be less than 10 mm (3/8") from the edge of the panel or edge of the framing member.

.8 Diaphragm and shearwall nailing shall not be over-driven by more than the following:

Panel thickness	Over-drive
9.5 mm (3/8")	1.4 mm (0.056")
12.5 mm (1/2")	1.9 mm (0.075")
15.9 mm (5/8")	2.4 mm (0.094")
19.0 mm (3/4")	2.9 mm (0.113")

.9 All structural dimensional lumber shall comply with csa-0141 and shall be kiln dried to maximum 19% moisture content prior to installation.

.10 All dimensional wood framing to be spf #2 or better unless noted otherwise, bearing the grade stamp of an agency certified by the Canadian lumber standards accreditation board.

ADDENDUM #5

Date: June 18, 2020

PACIFIC REGION
PORT HARDY LOGISTICS DEPOT
PORT HARDY, B.C.
Project No: 8H500

The following revisions supersede the information contained in the original drawings and specification issued for the above named project, and shall become part thereof. No consideration will be allowed for extras due to the contractor or any subcontractor not being familiar with this Addendum.

.11 Plywood for roofs, floors and walls shall be exterior grade douglas fir plywood to csa-0121 or Canadian softwood plywood to csa-0151.

.12 Plywood panels for floors and roofs shall be laid with a half-sheet stagger and be fastened to supports with 65 mm (2 1/2") common nails at 150 mm (6") o/c along panel edges and 300 mm (12") o/c along intermediate supports unless noted otherwise on the plans. Thickness as noted on the drawings.

.13 Plywood panels for walls shall be laid with a half-sheet stagger and be fastened to supports with 65 mm (2 1/2") common nails at 75 mm (3") o/c along panel edges for blocked edges, 150 mm (6") o/c for unblocked edges, and 300 mm (12") o/c along intermediate supports, unless noted otherwise on the plans. Plywood thickness as noted on the drawings.

.14 Shearwall panels shall not be glued in place unless prior approval is received from the engineer of record.

.15 Plywood for diaphragms and shearwalls shall have a 2 mm gap between panels.

.16 Exterior walls taller than 2400 mm (8'-0") shall have all panel edges blocked with 38 x 89 (2 x 4) on the flat.

.17 'ACQ' (amine copper quat) pressure treated wood shall be used where specified on the drawings, where timber comes in direct contact with concrete or masonry, and where it is exposed to the weather. Cut surfaces of treated timber are to receive a brush applied coat of coloured preservative. Work shall be in accordance with csa-080 series-08. 'CCA' (chromated copper arsenate) is not to be used. Treated wood products shall bear the stamp of the canadian wood preservers bureau (cwpb).

.18 Fasteners for use in ACQ treated timber shall be hot dip galvanized in accordance with ASTM A653, connectors shall have a g185 galvanized designation or meet ASTM A123. Alternatively, all metal connectors, including nails, bolts, hangers, hold-downs, steel straps, post bases, etc., shall be stainless steel types 304 or 316. Refer also to the preservative manufacturer's written recommendations.

.19 Wall studs shall not be notched, drilled or otherwise damage so that the undamaged portion of the stud is less than two-thirds of the depth of the stud if the stud is loadbearing or 40 mm (1 1/2") if the stud is non-bearing, unless the weakened studs are suitably reinforced. Such reinforcement shall be approved by the project engineer prior to the reinforcing being carried out.

.20 Top and bottom plates in walls shall not be notched, drilled or otherwise damaged so that the undamaged width is less than 50 mm (2"), unless the weakened plates are suitably reinforced. Such reinforcement shall be approved by the project engineer prior to the reinforcing being carried out. If plates are to be used as drag struts, see details.

.21 All posts, including 2-ply posts, are to be carried down to bearing and solid blocked at

ADDENDUM #5

Date: June 18, 2020

PACIFIC REGION
PORT HARDY LOGISTICS DEPOT
PORT HARDY, B.C.
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each floor level.

.22 Except at shearwalls, anchor bolts shall be 16 ø x 200 long @ 1200 mm o/c (5/8" ø x 8" @ 48" o/c) maximum. Locate bolts within 300 mm of each wall end and each side of openings which extend to the top of concrete. Refer to shearwall schedule for shearwall anchor bolts.

.23 All bolts used in wood frame construction shall conform to ASTM a307 or SAE j429 grade threaded rod shall be to ASTM F1554 grade 36 (36 ksi yield strength). Use of other bolts must be pre-approved by the engineer of record.

.24 All connectors and framing anchors specified must be pre-approved by the engineer of record prior to ordering. Installation of components and assemblies, shall be in accordance with the manufacturer's written instructions and/or shop drawings.

1.2 Section 07 52 00 Modified Bituminous Membrane Roofing
Delete:
2.8 Polyisocyanurte insulation
.1 Typical flatboard polyisocyanurate foam to ULC S704, Minimum 141mm thick equivalent to thermal resistance of R28, at any point of the roof. Refer to Section 07 21 00 Thermal Consultation.
Add:
2.8 Polyisocyanurte insulation
.1 Typical flatboard polyisocyanurate foam to ULC S704, minimum thickness as called out on drawings. Taper above minimum thickness as required to achieve required slope.

1.3 Section 07 61 00 Sheet Metal Roofing
Delete:
1.2 Section includes
Provide all material, labor and services necessary to design, supply and install pre finished metal standing seam roofing, galvanized metal ‘Z’ girts with concealed fastenings at canopy over Bike Storage Area and ARIEL Entry Vestibule.

1.4 Section 07 46 19 Steel Siding
Add:
2.1 Component
.2 Girts shall be ‘Z’-shaped, roll-formed from 0.53 mm hot dipped galvanized steel having a Z180 zinc coating to ASTM 525.

1.5 Section 07 46 19 Steel Siding
Delete:
1.1 Related requirements
.1 Air Barriers Section 07 27 00
Add:
1.1 Related requirements
.1 Sheet Waterproofing Section 07 13 00

ADDENDUM #5

Date: June 18, 2020

PACIFIC REGION
PORT HARDY LOGISTICS DEPOT
PORT HARDY, B.C.
Project No: 8H500

The following revisions supersede the information contained in the original drawings and specification issued for the above named project, and shall become part thereof. No consideration will be allowed for extras due to the contractor or any subcontractor not being familiar with this Addendum.

2.0 QUESTIONS

Q.1	Is there an Environmental Management Plan (EMP) or Construction Environmental Management Plan (CEMP) for this project?
A.1	The Environmental Management Plan is expected by the end of July.
Q.2	Spec Section 07 27 00 Sheathing Paper is referenced in section 07 46 19 but is not included in the documents. could we please get that added.
A.2	See revised section 07 46 19 above.
Q.3	Clause 1.5 of Section 26 42 00 states that the Contractor is to engage a NACE CP specialist to review and validate the CP system. We have engaged a NACE CP specialist and their opinion is that the CP system as currently designed is insufficient. They are recommending 4-6 anodes per pile. We are concerned that that the current design will not be validated by a NACE CP specialist and will not be sealed by a Professional Engineer. Based on our NACE CP specialist's review, in order for the system to be designed, installed, and function properly, changes to the tender design and drawings will be required. If each contractor is submitting a bid for a scope of work to be incorporated into the permanent structure, each contractor should be bidding the same design in order to have the tendering process be fair. We recommend one of the following options: PWGSC engages a NACE CP specialist and Professional Engineer to certify the design prior to tender closing; OR Have the contractor submit a price for the design as shown and any changes be addressed under a change order; OR Have the CP system as a Provisional Sum to be designed, supplied, and installed on a Time and Materials basis.
A.3	Please price the system as shown on the drawings and specifications.
Q.4	Please provide details of structural support for fall arrest anchors?
A.4	The fall arrest system shall be by design build with approval of Departmental Representative prior to installation.
Q.5	Section 07 52 00 page 4 (2.4) vapour barrier does not match page 6 (3.4) Please confirm vapour barrier type.
A.5	See Addendum #4, A.1
Q.6	Section 07 52 00 page 6 (3.4) Please confirm if gypsum sheathing is to be installed over plywood?
A.6	See Addendum #4, A.2
Q.7	Section 07 52 00 page 4 (2.8) please confirm if insulation required is R28 flat board plus taper package?
A.7	See updated section 07 52 00 as noted above.

ADDENDUM #5

Date: June 18, 2020

PACIFIC REGION
PORT HARDY LOGISTICS DEPOT
PORT HARDY, B.C.
Project No: 8H500

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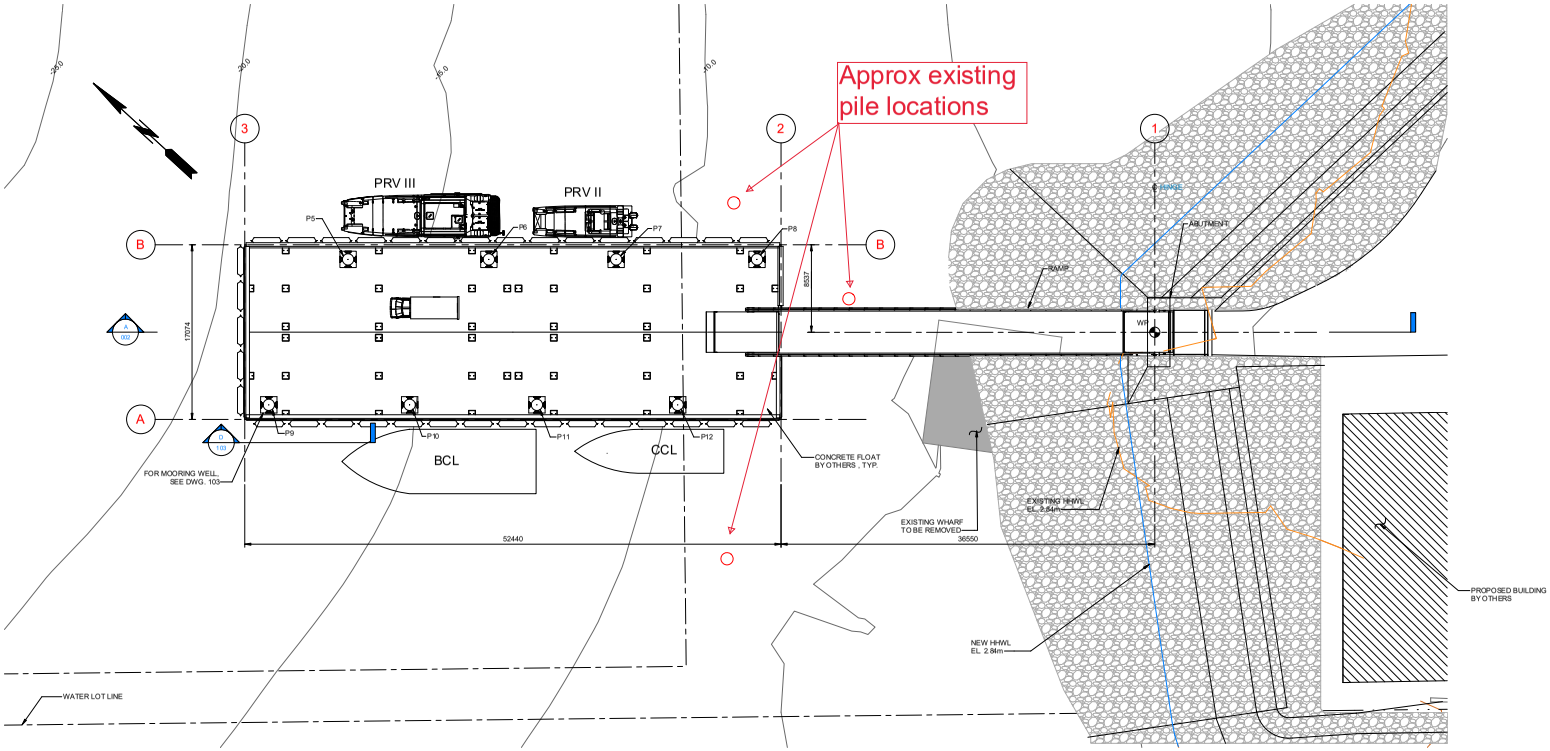
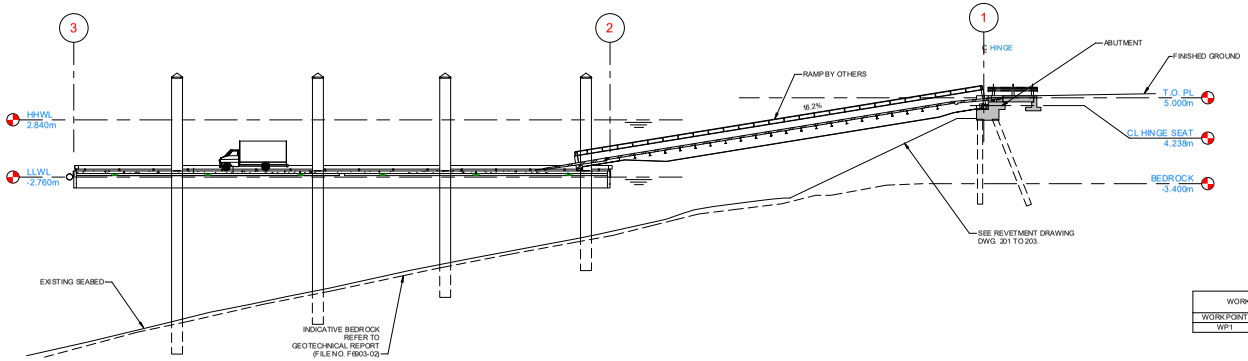
Q.8	Section 07 61 00 On the roof drawings it shows 6" of rigid insulation but the specification only calls for an R28 can we confirm the thickness of the insulation.
A.8	Bid project per Roof Legend on sheet A-01.
Q.9	The exterior wall assemblies list "thermally broken z-girts" (typ.) Is there a spec for what is required on these? I believe they are shown by the rectangles I've highlighted on detail 2/A-10.
A.9	See revised specification section 07 46 19 as noted above.
Q.10	After consulting with plastic suppliers for the mooring well wear pads (175mm x 223mm x 400mm), it is considerably more cost effective to purchase a 2 piece system to achieve the desired height of 175mm. Please advise if this system of two (2) pieces measuring (87.5mm x 223mm x 400mm) can be used as an alternative.
A.10	No.
Q.11	The Rock Revetment Specification section is a little jumbled. A table and some images are overlaying the text. Can PWGSC provide a updated version of this section?
A.11	See reprinted sections 35 31 19 and 35 31 20 in this addendum.
Q.12	*(not used)*
A.12	
Q.13	Addendum #4 – Q/A16 says the Vehicle Ramp will come fully assembled, yet Q/A40 says the Contractor will be required to assemble the aprons. Please clarify. Will the apron fingers be installed? Will the aprons be installed?
A.13	CORRECTION FROM PREVIOUS ANSWER: The aprons will not be installed on the ramp. The apron fingers will be installed on the apron.
Q.14	Pricing full extraction of the existing steel piles is a big financial risk to the marine contractor, especially considering there is no information on the pile details or installation details. Its debatable if full extraction is even possible, considering the piles are very likely drilled in. We request that you reconsider this issue. Is pile cut off at mudline acceptable?
A.14	CORRECTION FROM PREVIOUS ANSWER: Full pile extraction is preferred but cutting below the mudline will be accepted pending approval by Departmental Representative.
Q.15	We do not understand the response to Q19 on Addendum #4, that there is 6m between existing piles and the nearest new pile. Can the existing steel piles and new steel pile locations be illustrated on a General Arrangement? Currently this is information is presented in two drawings - there is not one drawing that shows both the existing and new piles (and therefore this potential pile conflict). We still believe there is conflict between one of the existing steel piles and float pile P8. See the sketch below where we have overlaid the float and the existing piles.
A.15	Please see attached sketch for accurate location of existing piles relative to new piles.



PLAN
1 : 200



A 002 ELEVATION
1 : 200

NOTE: MAXIMUM NEGATIVE GRADE OF THE RAMP IS 16.8% DURING OBSERVED HISTORICAL EXTREME LOW WATER.

WORK POINT COORDINATES		
WORK POINT	NORTHING	EASTING
WP1	5619575.821	607450.678

HORIZONTAL 1 : 40.0 HALF SIZE 1 : 20.0 FULL SIZE
0 2 4 8 16m
VERTICAL 1 : 40.0 HALF SIZE 1 : 20.0 FULL SIZE

NOTES:

1. FOR GENERAL NOTES, SEE DWG. 001.
2. FOR ABUTMENT PILES, SEE PILE SCHEDULE ON DWG. 101.
3. FOR MOORING FLOAT PILES , SEE PILE SCHEDULE ON DWG. 104.

Public Works and Government Services Canada / Travaux publics et Services gouvernementaux Canada

REAL PROPERTY SERVICES
Pacific Region
SERVICES IMMOBILIERS
Region de Pacifique

CHERNOFF THOMPSON ARCHITECTS

SNC·LAVALIN

Revision/ Révision	Description/Description	Date/Date
3	ISSUED FOR TENDER	20/03/20
2	ISSUED FOR TENDER	20/01/20
1	ISSUED FOR REVIEW	19/11/23
0	ISSUED FOR REVIEW	19/11/15

Client/Client
CANADIAN COAST GUARD - DEPARTMENT OF FISHERIES AND OCEANS

Project title/Titre du projet
6270 Jensen Cove Rd
Port Hardy, BC
V0N 2P0

PORT HARDY LOGISTICS DEPOT

Consultant Signature Box Only
C. LEHANE

Designed by/Concept par
N. SHAH

Drawn by/Dessine par
J. GENG

PWGSC Project Manager/Administrateur de Projets TPSGC
DON STORRY

PWGSC Regional Manager, Architectural and Engineering Services/ Gestionnaire régional, Services d'architecture et de génie, TPSGC
-

Drawing title/Titre du dessin
GENERAL ARRANGEMENT

1 : 200

Project No./No. du projet: **8H500** DATE 11/15/19
Sheet/ Feuille: **002** OF
Revision no./ No. Révision no.: **3**

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2020-05-02 10:38:30
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PART 1 - GENERAL

1.1 Description

.1 This Specification details the material and workmanship necessary to provide the minimum quality acceptable for the rock material for the revetment protection (armour and filter rock layers), and the transition to the pavement sub-grade. It should be referenced and interpreted simultaneously with all other specifications pertinent to the works described herein.

1.2 Related Specifications

.1 This Specification is not necessarily complete in itself and must be read in conjunction with the latest revision of other technical specifications and Drawings pertinent to the works described herein.

35 31 19 - Revetment Construction

.2 Below is a list of the Design Drawings related to these works, and herein referred to collectively as the Drawings:

201- Revetment Plan
202- Revetment Sections Sheet 1
203- Revetment Sections Sheet 2

.3 Should a conflict arise between this Specification and other technical specifications, this Specification shall apply.

1.3 References

.1 All materials shall be in accordance with the standards referred to in this specification. Where no specific requirement is stated, the minimum shall meet or exceed the requirements set forth in the American Society for Testing and Materials International (ASTM) standards:

i. ASTM C127-[04], Standard Test Method for Density, Relative Density (Specific Gravity), and Absorption of Coarse Aggregate.

ii. ASTM C535-[03e1], Standard Test Method for Resistance to Degradation of Large Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine.

iii. ASTM C136-[05], Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates.

iv. ASTM D698-[00ae1], Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/f3 (600kN-m/m3)).

1.4 Submittals

.1 At least 14 calendar days prior to commencing the work, inform the Engineer of proposed source of Products and provide results of grading analysis for each material proposed for use.

.2 Submit test results for each rock sample to the Engineer for review.

PART 2 – PRODUCTS

2.1 Rock Materials, General

.1 Rock materials referenced in this document pertain to the armour rock, filter, and transition to pavement sub-grade rock to be placed on the revetment.

.2 All rock materials from the quarry shall be rough angular quarried stone of a dense, hard, durable character, free of organic material, in-filled joints, seams or other defects, resistant to breakdown by handling, frost action or weather, and not subject to deterioration in sea water. As a minimum, rock shall meet the following test requirements:

Test	Requirement
Absorption (ASTM C127)	Not more than 2.0 percent
Abrasion, 500 Revolutions (ASTM C535)	Not more than 30.0 percent loss
Magnesium Sulphate Soundness, Fraction Loss at 5 Cycles (ASTM C88)	Not more than 15.0 percent loss
Petrographic Examination	Absence of weakness or materials that could result in significant stone alteration and reduction in durability
Degradation (ASTM D3744)	No index less than 35

.3 The rock shall have a unit mass not less than 2,600 kg/m³; i.e., a specific gravity (saturated surface dry) not less than 2.60.

.4 For armour rock and filter rock, mass governs the gradation and the Nominal Size is defined as:

$$D\ (mm) = 1000 * \left(\frac{W\ (kg)}{2{,}650\ \left(\frac{kg}{m^3}\right)} \right)^{\frac{1}{3}}$$

where W is the mass in kilograms and D is the nominal size in millimetres (mm).

.5 Each type of rock shall be graded between the limits specified, with the longest dimension of any piece not greater than 2.5 times its least dimension.

.6 Production of rock materials shall implement measures to accommodate the difference between the Nominal Size and the actual shape or dimensions of the rock materials.

.7 The quality of rock material used for the transition to pavement sub-grade must be sound, hard, durable material free from soft, thin, elongated or laminated particles, organic material, clay lumps,

organics, or other substances that would act in a deleterious manner.

2.2 Armour Rock .1 Gradation of Armour Rock shall be within the gradation limits shown in Table 1 and Figure 1. Material shall be reasonably well graded, within the prescribed limits.

Finer by Mass (%)	Mass (kg)	Nominal Size (mm)
95 – 100	4600	1200
80 – 100	4000	1150
50 – 90	3200	1070
20 – 50	2000	910
0 – 20	1100	750
< 5	600	610

Note: M50 shall be greater than 1300 kg and less than 3200 kg.

2.3 Filter Gradation .1 Gradation of Filter Rock shall be within the gradation limits shown in Table 2. Material shall be reasonably well graded, within the prescribed limits.

Table 1: Filter Rock Gradation

Finer by Mass (%)	Mass (kg)	Nominal Size (mm)
95 – 100	80	310
80 – 100	55	275
50 – 90	30	225
20 – 50	16	180
0 – 20	9	150
< 5	5	120

END OF SECTION 35 31 19

1.0 GENERAL

1.1 Purpose

.1 This Specification details the material and workmanship necessary to provide the minimum quality acceptable for the removal of debris, shoreline materials, and vegetation and the placement of armour, filter and transition rock material.

1.2 Specification for Related Works

.1 This Specification is not necessarily complete in itself and must be read in conjunction with the latest revision of other technical specifications and Drawings pertinent to the works described herein. The other technical specification and report listed below contain information related to work covered by this specification:

35 31 19 - Revetment Material

Lewkowich Engineering Associates Ltd., 2019. Geotechnical Evaluation-Waterside Jensen Cover Road, Port Hardy, BC

.2 Below is a list of the Design Drawings related to these works, and herein referred to collectively as the Drawings:

.1 201 - Revetment Plan

.2 202 - Revetment Sections Sheet 1

.3 213 – Revetment Sections Sheet 2

.3 Should a conflict arise between this Specification and other technical specifications, this Specification shall apply.

1.3 Reference Standards and Guidelines

.1 Standards:

BS 6349-7 1991 Guide to the Design and Construction of Breakwaters (amended January 2010).

.2 Guidelines:

CIRIA; CUR; CETMEF. The Rock Manual. The Use of Rock in Hydraulic Engineering (2nd Edition) (2007).

1.4 Submittals

.1 Work Plan as described in Section 1.5 - Health and Safety.

.2 Traffic Management Plan as described in Section 1.5 – Health and Safety.

.3 Transportation method as described in Section 3.2 – Transportation.

.4 The Contractor shall submit all necessary information to adequately evaluate progress claims:

.1 For each load of material delivered onto or removed from site, scale delivery slips stating type of material, gross mass, net mass, mass of delivery equipment, time and date of delivery, must be provided to the Engineer. Materials shall not be placed without provision of a scale delivery slip. Delivery slips for placed material or material removed from site shall be included in the daily report.

.2 Submit all survey and cross-section records to the Engineer within 2 business days after data collection.

.3 Submit all removed material volumes to the Engineer within 2 business days after data collection.

1.5 **Health and Safety**

.1 The Contractor shall prepare and submit a Work Plan, at least one week in advance of the work, to the Owner. The work plan shall include:

.1 Timeframe of construction, including start date, duration, and hours of operation. The Contractor shall indicate if night time works are anticipated and provide the anticipated methodology.

.2 Mode(s) of transportation and equipment, including a description of all machinery to be used during the work.

.3 Copies of operator certificates and licenses for the individual equipment operators.

.4 Number of expected loads of material / trips.

.5 The Contractor shall meet with BC Ferries representative as needed to coordinate staging areas and vehicle / pedestrian traffic. The Work Plan shall include details of the Contractor’s approach to coordination.

.6 Emergency response plan in the event of workplace incident or injury. The response plan shall be prepared in consultation with the Engineer and BC Ferries representative to ensure compliance with existing on-site procedures.

.7 Emergency contact phone numbers.

.8 Map showing route to nearest medical facility.

.9 Site specific risk assessment to identify risks and mitigations measures. The mitigation measures shall describe work site access controls and describe any required personal protective equipment (PPE). The mitigation measures shall include extra care taken when removing existing vegetation due to steep slopes.

.2 The Contractor shall undertake a toolbox meeting to review site safety at the start of each working day at the project site.

.3 The Contractor shall prepare and submit a Traffic Management Plan at least one week in advance of the work to Owner. The traffic management plan shall include:

.1 Details of signage, flagging, or other traffic control measures. Note that the work area shall be set up to avoid any interference with adjacent operations, and be staged to minimize interference with ongoing Langdale Terminal operations. The Contractor shall ensure that the work area is actively controlled to ensure no pedestrian or vehicle traffic can enter the work area without warning.

.4 The Contractor must supply and install materials for alleviation or prevention of dust nuisance caused by construction activities.

1.6 Facilities

.1 Temporary restroom facilities at the Site shall be the provided by the Contractor during the construction period for personnel working at the Site.

.2 The Contractor is responsible for providing temporary construction power, as required. Temporary power may be available upon request at the Site; however, this should not be relied on.

2.0 PRODUCTS

2.1 Materials

.1 Rock Materials:

.1 Rock materials referenced in this document pertain to the armour rock and filter rock to be placed as fill and on the face of the slope.

.2 Shall be of a quality as specified in the Material Specification Section 35 31 19

.3 Rock material shall be tested according to the requirements defined in the Material Specification Material Specification Section 35 31 19

.4 Each truck load delivered on site must meet the required gradation for the specific rock type.

.2 Outfall and Headwall:

.1 There are three storm outfalls within the revetment footprint. The approximate location and size of the storm outfalls are shown in the civil and mechanical documents.

.2 It is the responsibility of the contractor to ensure that the selected headwall product meets the requirements listed in Contract Documents.

2.2 Inspection

.1 Rock Materials:

.1 Prior to loading rock materials the Contractor shall inspect the materials to ensure that individual pieces do not contain weaknesses such as bedding planes, joint cracks, or other rock quality factors. Stones found to contain weakness planes or not satisfying rock quality criteria shall not be used.

.2 Prior to loading rock materials onto the barge or truck, the Contractor will set up a meeting at the quarry with the Engineer, to inspect the rock size and confirm that it meets the required gradation of the specific rock type. If, during the inspection, a batch of material is found to be made up of pieces that do not meet the specific gradation, the batch must be replaced and approved.

.3 Rock materials loaded onto the barge or truck and delivered on site must meet the required gradation for the specific rock type.

.4 The Contractor shall inspect the materials on-site to ensure that individual pieces do not contain weaknesses such as bedding planes, joint cracks, etc. Stones found to contain weakness planes or not satisfying rock quality criteria shall not be used.

.5 The Engineer or Owner's Representative reserves the right to inspect and approve or reject rock materials at any time prior to and during placement of the revetment.

.6 At no additional cost to the Client, any barge or truckload of rock material that arrives on site may be checked randomly, at the discretion of the Engineer, to confirm that it meets the gradation of the specific rock type.

.7 In addition to the daily checks, if, at the discretion of the Engineer, any barge or truckload appearing to have a gradation that does not meet the specific rock type, construction will be stopped, and the load checked. These checks will be at the expense of the Contractor.

.8 The Contractor shall provide, at no additional cost to the Client, the means of weighing armour rock at the Quarry or source and on site. Note that a bucket loader equipped with a scale and slings is acceptable for weighing individual rocks.

.9 If, during the inspection of rock materials, a particular load is found to be made up of pieces that do not meet the specific gradation, the Contractor shall be responsible to replace the deficient size. Note: There is limited room on site to stockpile rock material for later use, and any additional transportation and handling charges incurred from the delivery of rock material that does not meet gradation shall be covered by the Contractor at no cost to the Owner. It is strongly recommended that the Contractor setup good QA/QC procedures at the quarry where materials are loaded for transport to the site.

.2 Existing armour:

.1 The Contractor shall inspect the materials to ensure that materials are suitable for incorporation into the revetment. The existing armour surface must be clear of sharp protuberances and/or local pockets of similar rock sizes.

.2 Any large material unstable / unsuitable must be removed or replaced.

.3 The Engineer must inspect and approve the existing armour conditions prior to filter placement. See also Section 3.4 - Removals

2.3 Measurement and Payment

.1 The baseline of the revetment is identified by sections connected to Work Points at the Revetment Crest as shown in the Design Drawings.

.2 The measurement of payment shall be as below:

.1 Supply and place filter rock: by mass (weight slips) and by volume (survey);

.2 Supply and place armour rock: by mass (weight slips) and by volume (survey);

.3 The pre-construction survey shall be completed after the removal of vegetation, unsuitable material and garbage from the shoreline, to allow for accurate measurement.

.4 Material graded or removed beyond the design line and grade shown on the Design Drawings will not be paid for unless these changes were requested by the Engineer.

.5 Rock materials that have been determined from survey to be placed outside of tolerance will not be paid for, and the estimated mass of this material will be deducted from the weigh slip totals.

.6 The calculation for the mass of excess rock materials shall be based upon the volume of material (as determined by survey data), the assumed porosity of the placed material, and the rock density.

$$W(kg) = Volume\ (m^3) \times (1 - Bulk\ Porosity) \times \rho(\frac{kg}{m^3})$$

Where W is the mass (kg), ρ is the rock density (kg/m3), and Bulk Porosity is the result of void spaces between individual rocks.

.7 The design in-place bulk porosity, for the theoretical volumes of the filter, transition and armour rock material layers is:

.1 Placed Filter Rock: 30 percent

.2 Transition Rock to Granular Sub-Base: 30 percent

.3 Placed Armour Rock: 35 percent

.8 If the Contractor disputes the assumed bulk layer porosity given in this document, they may, at their own cost, setup a test section on site and place material to the satisfaction of the Engineer within the test section. The bulk layer porosity shall then be determined from a survey of the volume of the test section along with the total weight of material placed into the test volume. The test volume shall be sufficiently large to be representative of a section of placed material.

.9 Before placement of any overlying material of different type to the underlying material, the underlying material shall be surveyed and survey results approved by the Engineer. Surveying should be completed with approved and calibrated GPS survey equipment that can provide horizontal coordinates and vertical elevations as per the project standards.

.10 Cross-sections of the completed work shall be surveyed perpendicular to the control line of the revetment at no more than five (5) m intervals (along the baseline). Measurements shall be taken at no greater than 1.5 m intervals along each individual cross-section. Coordinates shall be in UTM Zone 10, NAD83, as per drawing standards. Vertical datum is Geodetic Datum CGVD2013.

.11 The Contractor shall provide all surveying necessary to lay out the work, proceed with placement, provide quality control, and measurement for payment.

.12 Site clean-up will be to the satisfaction of the Engineer, and will entail the removal of all equipment (machinery, support equipment, construction debris, silt-fencing and flagging, etc) from the project site. The intent is that the Site will be returned to a pre-construction condition in all areas outside of the completed works.

3.0 EXECUTION

3.1 General

.1 The Site is subject to natural water level fluctuations due to tides, waves and currents. Storm events may cause water levels to exceed normal ranges. The contractor shall familiarize themselves with these conditions prior to undertaking the work.

.2 The Contractor is advised that tidal and storm conditions may impact construction operations and they shall be prepared to work around these conditions.

.3 Any loose or unconsolidated areas of the slope following excavation shall be compacted to the satisfaction of the Owner's Representative prior to placement of rock material.

.4 Recovery or replacement of any materials displaced by storm events or vessel wake shall be at the Contractor's expense and at no cost to the client

3.2 Transportation

.1 Rock materials shall be handled and transported to the appropriate location of placement so that each type retains its qualification as the specified gradation and materials and in such manner to prevent segregation or breakage. Note: As there is limited space on site to store or sort rocks, it is important that each delivery of material to the Site meets the gradation specification.

.2 The contractor is free to propose the method of transportation and it shall be submitted in writing to the Engineer at least one week in advance. The Engineer shall observe the method of transportation to monitor breakage or abrasion occurring in transport.

.3 Once approved, the proposed method shall not be changed without prior written authorization from the Client.

.4 Transportation can be stopped at any time by the Engineer if he considers the method does not maintain the required gradation for the required material. Any time lost of this shall be at the Contractor's expense.

3.3 Site Preparation

.1 A pre-construction survey must be conducted prior to commencement of work on site (see also Section 2.3 – Measurement and Payment).

.2 Prepare and grade slopes as shown on the Design Drawings and as directed by the Engineer. Slope must be cleared of debris or sharp objects and unsuitable / unstable material, smoothed, made uniform, and ensured that it is clear of sharp protuberances and/or local pockets.

.3 The Contractor shall plan their excavation and rock placement work to minimize the time in which excavated sections are left uncovered by rock armour. It is brought to the Contractor's attention that a wind event occurring at high tide conditions could damage the project site, and it is for this reason that the work must be planned and executed to ensure excavated slopes are covered in the design rock sections quickly. The Contractor shall monitor weather forecasts and not proceed with excavation work when adverse weather is forecast in the near future. It is recommended to only excavate an area for one day's worth of work during low tide, including placement of Filter Rock. This is important to ensure there is no need to de-water previously excavated areas, as excavations will flood during high tides.

.4 Excavated material must be placed back after Armour Rock placement (on top and around armour).

3.4 **Removals**

.1 Broken concrete blocks, asphalt slabs, broken fencing, out of service drainage pipes, and other non-natural materials shall be removed and cleared from the beach area.

.2 Existing vegetation within 2m of the existing slope shall be removed and grubbed from the slope and upland area.

.3 Materials not suitable for incorporation into the revetment include, but are not limited to: large woody debris, metal debris, plastic, broken asphalt, and concrete slabs.

.4 All materials removed shall be disposed of in appropriate disposal facilities in accordance with all local laws and regulations.

3.5 Placement of Filter Rock

.1 Filter Rock shall be handled and placed in such a manner as to prevent segregation and to provide a stable and well-graded in-place mass. The handling and placement procedures shall avoid mixing of different types of rock and avoid contamination of the placed mass of filter rock. Any undersized or contaminated sections of materials are to be removed and repaired at the Contractor's expense.

.2 Filter Rock must be placed with a layer thickness as shown on the Design Drawings.

.3 Filter Rock shall be placed beginning from the toe of the slope, working up the slope. The finished surface shall be densely placed, well keyed, and uniform. Fill voids, rework rocks not properly embedded, and remove protuberances to the satisfaction of the Engineer.

.4 Filter Rock may be placed in bulk and subsequently trimmed to the elevations, thicknesses, slopes, and lines shown on the Design Drawings. Use methods to ensure that the finer one-third of the gradation is evenly distributed throughout the layer and over the surface being covered.

.5 Remove and replace the portion of any layer in which material becomes segregated during spreading.

.6 Settlement is possible during construction. The Contractor shall use their available equipment (such as the bucket head) to tap down placed filter material to check for compaction. In the event of compaction or settlement, additional material, of the same type, shall be placed to ensure the required design elevations are achieved. This material shall be added prior to the placement of the Armour Rock. If settlement continues to occur, additional material shall be added at the direction of the Owner's Representative to maintain final design elevation (as required) until the end of the construction period.

.7 All material shall provide a stable, interlocked, and well-graded in-place mass.

3.6 Placement of Armour Rock

.1 Armour rock shall be handled and placed in such a manner as to prevent segregation and to provide a stable, interlocked, and well-graded in-place mass. The handling and placement procedures shall minimize breakage of the stone, avoid mixing of different types and avoid contamination of the placed mass of rock material. Any undersized stones or contaminated materials are to be removed at the Contractor's expense.

.2 Care must be taken when placing Armour Rock to avoid disturbing the filter layer. Armour Rock shall not be dropped onto the filter layer from heights higher than 0.8 m above the filter layer or already placed Armour Rock.

.3 Place Armour Rock in the locations and to the elevations, thickness and details indicated on the Design Drawings and as directed by the Engineer. Use methods to ensure that the finer one-third of the gradation is evenly distributed throughout the layer and over the surface being covered.

.4 Begin placement of Armour Rock at the toe of the slope and continue placement working up the slope. Place the rock in at least two layers in such a manner as to create firm bedding and interlocking of individual pieces to obtain a tightly packed structure. The finished surface shall be densely placed, well-keyed, and uniform. Individual rocks shall have at least three (3) points of contact to adjacent rocks. Fill voids, and rework or replace rocks not properly embedded, and remove protuberances, to the satisfaction of the Engineer. Remove and replace that portion of any layer in which material becomes segregated during spreading.

.5 Settlement is possible during construction. As a consequence, additional material, of the same type, shall be placed to ensure the required design elevations are achieved. If settlement continues to occur, additional material shall be added at the direction of the Engineer to maintain final design elevation (as required) until the end of the construction period.

.6 Remove and replace any portion in which material becomes segregated during placement to avoid any large areas of small armour rock.

.7 All material shall provide a stable, interlocked, and well-graded in-place mass.

3.7 Tolerances

.1 The tolerances given below are the technically accepted tolerances.

.2 All dimensions, thicknesses, and profiles of the slope protection as shown on the Design Drawings are minimum dimensions/profiles. Locally acceptable lesser thicknesses are defined below.

.3 All rock materials shall be placed to the lines, grades, and elevations indicated on the Design Drawings.

.4 The horizontal location of the edge of crest or the toe of slope for any material along the revetment face shall not deviate from the design location by more than 0.2 m.

.5 The maximum permissible variation in the finished thickness of Filter Rock or Armour Rock layers, when measured as the perpendicular dimension between the top and bottom surface planes, shall be within -10 to +15 percent of the layer thickness indicated on the Design Drawings. For the purpose of measuring layer thickness, the surface planes shall be considered to pass through the average location of the crests of the individual rocks on the surface.

.6 Excavation slopes shall not deviate from the design elevations by more than 180mm.

.7 Finished slope angles of filter rock or armour rock layers shall not be steeper than the design slopes shown on the Design Drawings. Slopes may be milder, to within 2 degrees of the angle corresponding to the slope specified on the Design Drawings.

3.8 Outfall and Headwall

.1 The Contractor shall be responsible for confirming the existence, size, and location of any outfall that may be affected by the work.

.2 The Contractor shall be responsible for notifying the Engineer of conflicts or potential conflicts between the proposed work and existing conditions, and shall be responsible for damage that occurs due to contractor's negligence.

.3 The Contractor shall be responsible for extending the storm outfall, as necessary to install a headwall with grills as specified in the Civil and Mechanical Contract Documents.

3.9 Restoration

.1 Upon completion of work, remove and dispose of surplus materials and debris off Site.

.2 Clean and reinstate areas affected by work as directed by the Engineer.

4.0 QUALITY CONTROL

4.1 Quality Assurance

Quality Assurance refers here to administrative and procedural activities that will be implemented by the Contractor within their quality system to ensure that the rock materials as placed on-site meet the requirements of this specification.

The Contractor shall be responsible for monitoring and reporting on quality. The Contractor shall identify a person on their team who is responsible for Quality Assurance and who will develop the specific procedures (Quality Controls) to be used by the Contractor in the execution of their work.

4.2 **Quality Controls at Quarry**

The Contractor shall, at a minimum, develop the following quality control procedures for the work at the quarry:

.1 A quality control procedure at the quarry to ensure proper rock gradation is produced. A written plan of the steps to be taken at the quarry to ensure proper delivery of rock materials to the project site shall be prepared and submitted to the Owner's Representative for approval. At a minimum the plan shall include:

.1 Monitoring of intrinsic rock properties for: geological variability, changes in petrography, density, porosity, and discontinuities in the rocks. The plan shall identify who at the quarry will monitor intrinsic properties.

.2 Mass distribution controls: A weighing device or load cell is required to weight individual rocks and obtain gradation curves from stockpiles (See Section 5.0). The plan shall identify the equipment and list the frequency with which gradations will be checked.

.3 To assist quarry operators who must sort rock, a set of reference stones with their mass painted on them shall be setup near to the work area in the quarry. The reference stones should represent the upper and lower bounds for the median rock weight, along with upper and lower size rocks for the overall gradation.

.4 Controls to remove rocks from the stockpiles for which the longest dimension of any piece is greater than 2.5 times its least dimension.

.2 A test shall be arranged to weigh rocks at the quarry(s) from the stockpile(s) of material prepared for the project prior to shipment to confirm the gradation by mass. This test shall be separate to the mass distribution controls used at the quarry to prepare the stockpiles and shall be witnessed by the Owner's Representative.

It is emphasized that most of the quality control should be performed at the quarry to minimise the risk of transportation of unsuitable materials.

4.3 Quality Control during Delivery and Construction

The Contractor shall develop a quality control plan for the work site that ensures the proper gradation of rock material is achieved in the finished works. A written quality plan shall be developed that:

.1 Identifies the Contractor employee on-site responsible to ensure rock quality is achieved.

.2 Provides a plan for testing rock gradations on site. This could include a combination of estimating mass by dimensional measurement of the rock, along with limited weighing of rocks. Particular control will be required if local stockpiles are used in which materials obtained locally from excavation are to be worked into material obtained off-site.

.3 Establishes protocol for the visual control of the shape of the rocks.

.4 Ensures inspections are undertaken for breakage from each delivery. Excessive breakage can result in a change of the gradation.

.5 Include a plan that specifies the equipment and procedures to be used to ensure that rock placement is as per the locations, dimensions, slopes and thicknesses as indicated on the Design Drawings.

5.0 CALCULATION OF GRADATION

This section provides guidance on the methods that the Owner's Engineer will use to determine gradation. It is recommended that the Contractor adopt similar methods for their own Quality Controls. It is expected that the Contractor will undertake gradation checks and provide results for all classes of rock as part of their quality control.

5.1 Gradation from Weights

The following is an example of how to calculate the mass distribution curve for a selected sample of 30 rocks. In the example, 30 individual rocks are selected from a stockpile and weighed. It is important that all rocks within an area of the stockpile selected for inspection are included (i.e. smallest rocks are not ignored). If by visual inspection one area of the stockpile has notably larger (or smaller) rocks than another area, then the Contractor should re-sort the stockpile using equipment to ensure there is no segregation of rocks sizes.

Row	C1 Rock Mass kg (sorted from smallest)	C2 Cumulative Mass (kg)	C3 Cum % by mass less than
1	650	650	1.1%
2	710	1360	2.3%
3	740	2100	3.5%
4	910	3010	5.0%
5	1140	4150	6.9%
6	1270	5420	9.0%
7	1340	6760	11.2%
8	1390	8150	13.5%
9	1470	9620	16.0%
10	1590	11210	18.6%
11	1630	12840	21.3%
12	1670	14510	24.1%
13	1730	16240	26.9%
14	1820	18060	30.0%
15	1890	19950	33.1%
16	1990	21940	36.4%
17	2020	23960	39.8%
18	2090	26050	43.2%
19	2190	28240	46.9%
20	2260	30500	50.6%
21	2390	32890	54.6%
22	2480	35370	58.7%
23	2500	37870	62.8%
24	2640	40510	67.2%
25	2740	43250	71.8%
26	2790	46040	76.4%
27	3020	49060	81.4%
28	3250	52310	86.8%
29	3420	55730	92.5%
30	4530	60260	100.0%

Figure 1: Table of Measured Gradation

Individual Rock mass shall be listed in a table, and sorted from smallest to largest. (See column C1 in Figure 1 as an example). From this the cumulative mass is determined (Column C2) and the cumulative % mass (Column C3).

The results should be plotted on a curve with the gradation limits shown in order to ascertain if the test sample meets the specification (see example on Figure 2).

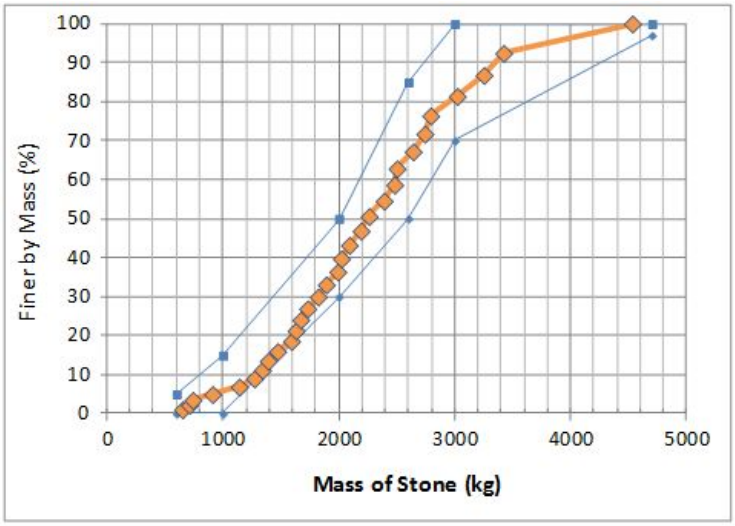

Figure 2: Plot of Measured Gradation (example)

The weighing of individual rocks is not a common operation at a quarry, and it is recommended that specific safety protocols be developed for the procedure. Figure 3 and Figure 4 show examples of rocks being weighed individually.

Figure 3: Individual rock weighing at quarry using a floor scale on beams
(Ref: CIRIA C683)

Figure 4: Individual rock weighing using load cell and slings

5.2 Gradation from Dimensional Measurement

A supplemental method to direct weighing of individual rocks is to estimate the rock mass from three dimensions. This can be done relatively quickly at site to check the consistence of rocks being worked from a stockpile, and only requires a tape measure and a field notebook.

The method is subjective, and requires some eye ‘calibration’ by the team in the field making the estimates. The person making the measurements must estimate the ‘blockiness’ value (BL) of the rock (see Figure 5).

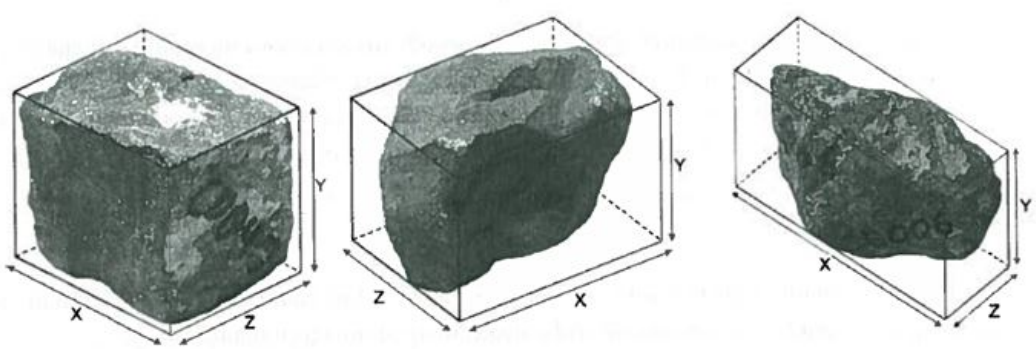

Figure 5: Rock Blockiness Examples, Left to Right, BL = 80%, 60%, 40% (CIRIA C683)

The mass of an individual rock is estimated by taking three mutually perpendicular measurements of the rock (x,y,z) as best as possible in the field or at the quarry. A BL value is then estimated, and the mass of the rock determined as follows:

Mass = X Y Z (BL) (ρ)

Example: A person measures a rock 1.35m by 0.85m by 0.7m, and estimates the BL coefficient as 60%. The rock material has a density of 2650 kg/m3. The mass is thus determined as:

Mass = (1.35m) x (0.85m) x (0.7m) x (0.6) x (2650kg/m3) = 1280kg

The methodology outlined above is based on estimating and adjusting the outer inscribed equivalent block based on the larger mutually perpendicular dimensions of the rock. A methodology based on estimation of a smaller inscribed solid block is also acceptable.

These methods of estimating mass should “calibrated” by weighing a sub-sample of measured rocks to verify the estimates of BL being used by personnel and help to “calibrate” the field staff who are evaluating rock onsite as per Section 4.3.

Once a number of rocks have been measured and the mass estimated, the gradation can be determined in the same manner as given in Section 5.1.

END OF DOCUMENT

ADDENDUM #5

Date: June 18, 2020

PACIFIC REGION
PORT HARDY LOGISTICS DEPOT
PORT HARDY, B.C.
Project No: 8H500

The following revisions supersede the information contained in the original drawings and specification issued for the above named project, and shall become part thereof. No consideration will be allowed for extras due to the contractor or any subcontractor not being familiar with this Addendum.

END ADDENDUM #5